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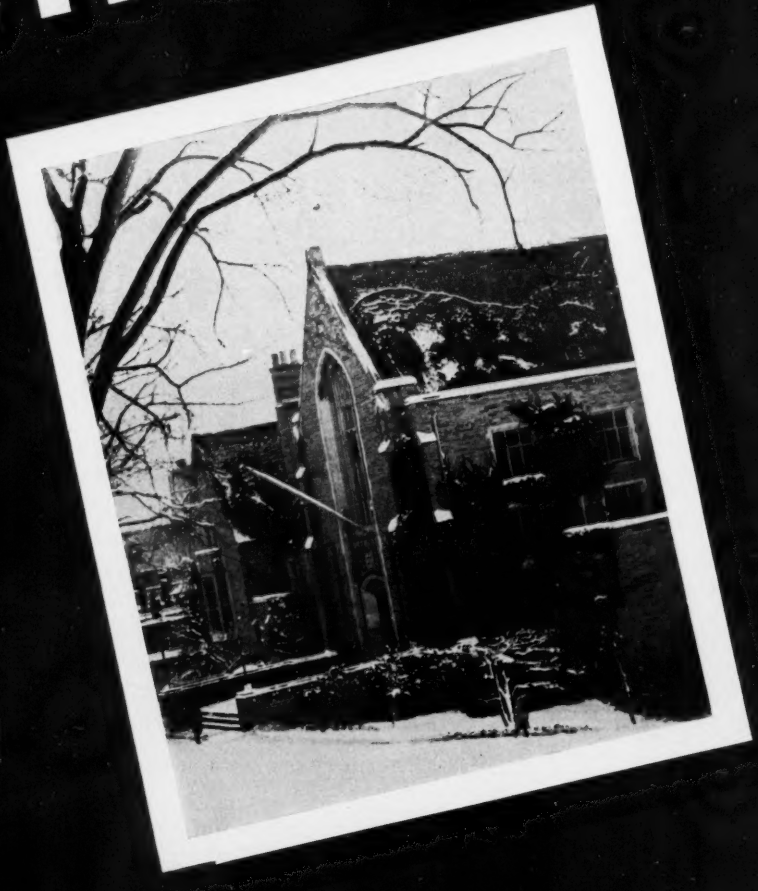

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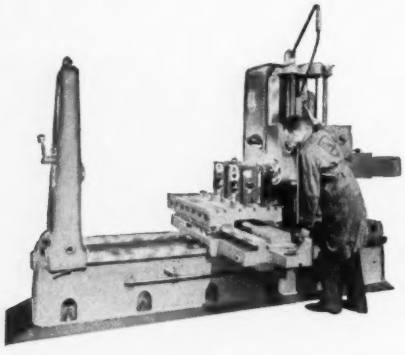

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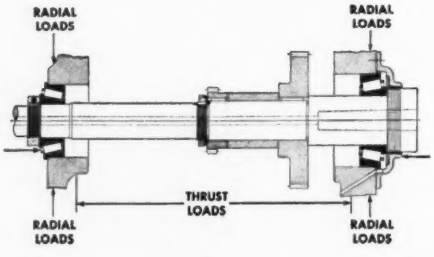

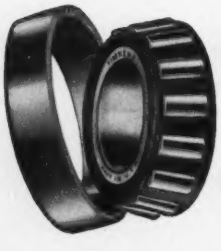

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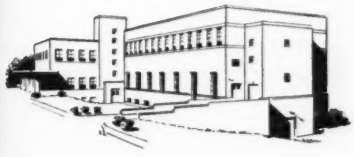

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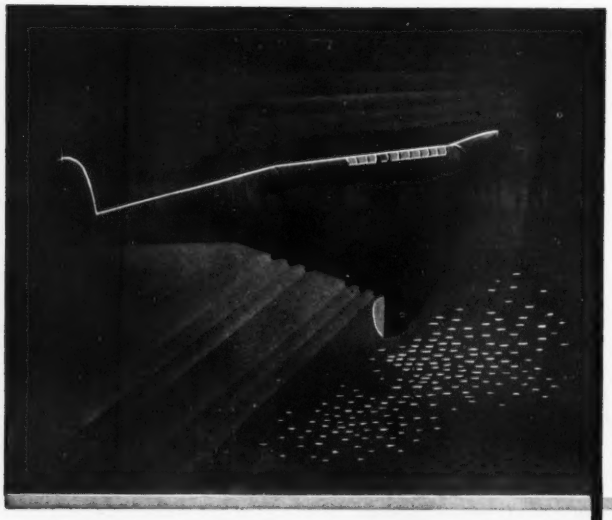

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Cover—Snow-covered entrance to Willard Straight Hall announcing the return of winter to Cornell.

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THE IMMINENT ENGINEERING SHORTAGE

By DEAN S. C. HOLLISTER

Our country is once again obliged to arm in an effort to preserve peace, and to prepare for attack if it should come. No thinking person fails to grasp the fact that we are greatly outnumbered and that our chances of survival are dependent upon our ability to out-design, out-develop, out-produce, and out-perform our enemies. At the same time that we are preparing for possible large-scale war, we must maintain, on a more efficient basis than ever before, our civilian functions. Moreover, we must prepare for eventual attack on our cities and on our industries and for the invasion of our homeland.

Contribution of Engineers

World War II brought to public attention the extent of the contribution to the war effort of the scientists and engineers. We could not have fought, much less won, that war without the vast equipment planed, developed, built, and operated by engineers. Not only have the engineers provided the country with the labor-saving devices, the means of transportation, communication, production and distribution in peacetime, but they have also provided the special versions of all these services for war. The engineers design, develop, produce, and operate the ships, the planes, the guns, missles, rockets and ammunition, the tanks and armored vehicles, the radio, radar, sonar, loran, and other devices of communication and detection, the vast transportation facilities needed in warfare. They are clearly indispensible.

But we are short of engineers. As we advance in the war preparations the shortage will be greater. As one contemplates the dependence upon engineers in the task before us the seriousness of a shortage in this part of our manpower becomes evident. It comes about because there has been a falling off in enrollments in engineering colleges, largely due to a widely and erroneously held belief that engineers were in oversupply. The shortage will deepen if engineers are drafted or called up as reservists and used in positions for which engineering training and experience are not mandatory.

The adjoining chart presents the essential factors in the outlook for supply of engineering graduates. The lower curve shows the annual output of the engineering colleges of the country for the academic years 1935-36 to 1950-51. It shows that from 1942 through 1945 the country, through its mistaken manpower policy, all but stopped the operation of engineering education. That is the reason why industry today is not successful in finding critically needed engineers with 5 to 10 years experience. They were not produced at the rate they should have been.

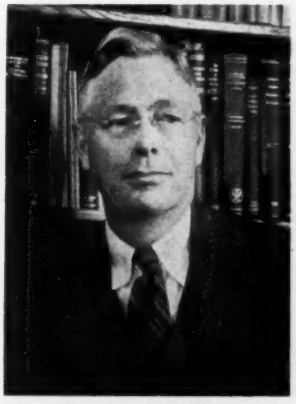
Beyond 1950 a dotted line shows the estimated number of graduates to be expected if the schools operated without any withdrawals by Selective Service. It represents the most optimistic production possible,

Miss Liberty still casts her reassuring light, a source of hope for all who question the future. (See Editorial, page 17.)

THE AUTHOR

When predications of an oversupply of engineers were widely publicized early in 1949, Dean S. C. Hollister refuted this view and prepared an analysis indicating an actual subnormal flow of graduates into the profession for some years to come. A study of this situation was presented in his article in the May 1949 issue of the ENGINEER, "The Trend in Engineering Enrollments".

Dean Hollister's observations have been rapidly substantiated by the sudden urgent need for engineering manpower in our defense program. When Engineers Joint Council established a Manpower Commission several months ago to deal with this critical problem, Dean Hollister was asked to serve on the Commission. The accompanying article stems from this work and represents one of the efforts of the Commission to make known the serious facts of the situation.



Dean S. C. Hollister

at least until 1954, since all classes graduating up to that year are already enrolled in the colleges.

Since the number of graduates depends upon the number entering the colleges, the curve of freshmen is shown. Again is evident the low enrollment of freshmen of the war years, many of whom were taken out of college for military service. Following the war, the veteran benefits program brought the unprecedented number of 91,000 freshmen into the colleges in the fall of 1946. These did not come direct from the high school graduations in that year, but represented an accumulation of high school graduates who, for several years, had not been permitted because of the draft to proceed with college training. Since 1946 the numbers of freshmen have fallen rapidly until in 1950 there are enrolled about 30,000.

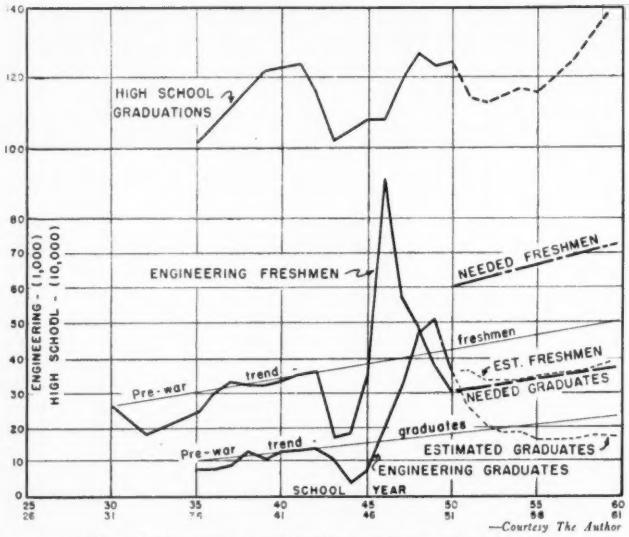
Beyond 1950 there is shown a dotted line indicating estimated freshman enrollment. This estimate was made before the Korean War, and was based on normal peacetime expectancies. It is seen that the actual enrollment for 1950 did not reach the estimate, due largely to widespread rumor that the engineering field was over-supplied.

Present Situation Tight

The present situation already show tightness in all fields, and critical shortages in many. Industry has absorbed the last two graduating classes of nearly 50,000 each and is hotly contesting for the 30,000 that will graduate in 1951. Many of the graduates are in ROTC programs and may thus go direct to military service. A large number have draft postponements and will be subject to call in June, if not before. Still others are veterans.

On August 3, 1950 the Secretary of Labor placed all branches of engineering on the list of critical occupations. In all the major branches, the shortage of engineers is becoming progressively more critical, especially in aeronautical, chemical, electrical, and mechanical manufacturing fields. Men with a few years of experience are almost unobtainable.

In normal peacetime it is generally accepted that at least 20,000 graduates are required annually. In the present situation it should be



—Courtesy The Author

Chart showing trends in engineering enrollment and graduation.

recalled that industry has absorbed 50,000 engineers in each of the last two years; but some of these certainly take the place of those that could not be hired in war years because in those years they were not being produced except in small numbers. Industry, however, does not have all it needs; and the military requirements have not as yet been taken. It thus appears that the minimum annual need is not less than 30,000 engineering graduates with use for many more if they should be available.

Increasing Graduates

How do we obtain not less than 30,000 graduates yearly? First of all, to do so requires an annual input of 60,000 freshmen. This is about double the number entering engineering schools this year. How may twice as many high school graduates be attracted to engineering schools? Are there that many among the high school graduates who have an interest in engineering and who, at the same time, have the necessary aptitude and abilities?

The numbers of male and female high school graduates anticipated are shown at the top of the chart. It appears that between 1950 and 1958 there will be a 10% dip in the numbers graduating so that the range is between 1,250,000 and 1,130,000. We clearly cannot rely, therefore, upon an increase in output of the high schools to solve the problem.

Talent Limited

Except for the war and immediate post-war years, which were abnormal, the numbers entering engineering schools since 1935 range from 2.7 to 3.1 percent of the total high school graduating classes. On the basis of an average high school output of 1,200,000 boys and girls, 5% would be required to produce 60,000 engineering freshmen. This is about 10% of the boys graduating from high school. There is some doubt whether the combined factors of aptitude, ability and interest would be found in so high a percentage. It seems possible that the 60,000 freshmen shown as needed on the chart may be at or above the available number that can be expected to enter engineering. This brings home the clear fact that there is not, and there cannot be developed, an inexhaustible supply of engineering talent but instead the supply is sharply limited.

Nevertheless, it is essential that all available avenues of information be used to acquaint the high school principals, high school guidance

(*Concluded on page 24*)

Stream Pollution Control

By JOHN R. HOFFERT, C.E. '11

Illustrations courtesy the author

With the maturing age of a country, as with a man, there comes a greater concern about the future and what will be left to those who follow after. So, in this land of ours, unparalleled in natural resources, and in which in early years it was not only the practice but the necessity to cut down and burn the forests to clear the land for farming, to discard all but the most salable coal and ore; to let go to waste vast quantities of natural gas, and generally to use with prodigal hand much of our natural heritage, there gradually came a realization that our natural resources were not inexhaustible. Long ago our clearer-thinking people saw that we had already made deep inroads into our mineral, forest and wild-life resources, and with prophetic vision, they became crusaders for the conservation of our heritage.

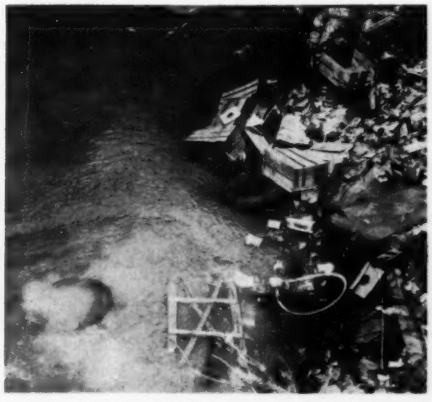
Over the long years, and at times, in the face of ridicule, opposition by selfish interests, and apathy upon the part of the general public, these zealous ones worked to arouse the country. Gradually, too, they did begin to create interest, succeeded in having necessary laws passed, and in getting them effectively enforced. The serious inroads upon our irreplaceable natural resources by two world wars have at last brought home to most of us the critical need to conserve *all* of our resources—human as well as material.

Resources Not Inexhaustible

However, for far too long most of us have been prone to think of two of our natural resources as inexhaustible or more or less self-renewing. We have overlooked the enormous drain upon the topsoil of our lands—that thin layer of humic material upon which our very life depends. Also, we have too often failed to realize that our very life is likewise dependent upon our water supply and that we have depleted or polluted our water resources to the point where in many places we face a critical condition. This situation did not, of course, come about suddenly; it has been gradually developing ever since the founding of our country; but few, except for the conservationists, water works men, fishermen, and lovers of the outdoors, were concerned until the great increase in stream pollution brought about by

A river the way God left it.

And what man did to it.



A small modern sewage treatment plant.

the universal sewering of our communities and our enormous industrial expansion, has at long last aroused our people to the need for action.

In our country's development we have passed through our frontier and trail blazing days; our early turnpike and canal building periods; our railroad and highway building; and we are now in our era of superhighways, air-ways, and public health sanitation. We are also now well into an era of stream cleanup. We have already passed through the trying period in which those "crying in the wilderness" had to fight opposition from all sides. We have now arrived at the point where, in 44 of our states, there is a law of some sort limiting stream pollution—woefully inadequate in many states, it is true, but with plenty of "teeth" in many of the more populous and advanced ones. Furthermore, with the enactment of Public Law 845 on June 30, 1948, by the Congress, the Federal Government also has been given some control over stream pollution. It is not now a question of whether we are going to have stream pollution control; the problem now is to bring it about in the true spirit of conservation—that is, by the wise use of our streams for all of their legitimate purposes, and not in an irrational, unnecessarily costly, or discriminatory way.

Points To Remember

Specifically, this means that our ardent conservationists, those who now pollute the streams, and the administrators of the anti-pollution laws, must realize and remember at least five things. They must know that, for very good reasons, not all of our streams will be brought back to the same degree of cleanliness—especially downstream from points of concentrated waste discharge. Also, they must bear in mind that it will take time to abate pollution—often more time than it seems should be necessary—and that often the needed improvements must come in stages. Then, too, they must remember that removal of pollution will cost real money—in the case both of municipal sewage and industrial wastes huge sums must frequently be spent, and each will be called upon to pay his share. Also, it must be borne in mind that for some wastes there are not yet available satisfactory methods for abatement or treatment. And, finally, all must remember that pollution abatement and control must be a cooperative work upon the part of the ardent conservationists, those who now pollute our streams, and those who administer the anti-pollution laws; that it will require genuine understanding, reasonable patience, and a firm but equitable and sympathetic application of the law—there must be a reasonable tolerance upon the part of all, not just a "cracking down with the law."

When our country was young, and its population sparse, it was entirely practical to send all our wastes — sewage and the limited quantities of wastes from our infant industries — direct to the nearest water course. But with the great growth of our municipal sewer sys-

THE AUTHOR

John Raymond Hoffert was born in Omaha, Nebraska, and educated in the schools of Steelton and Harrisburg, Pennsylvania. At Cornell, he was a Fuertes Gold Medalist and a member of Sigma Xi and Tau Beta Pi. He was also the C.E. College Athletic Director and on the track and cross-country teams.

John Hoffert

After receiving his C.E. degree in 1911, he became associated with the Harrisburg park system and the Harrisburg Planning Commission. He was an engineer with the Bridge and Construction Department of the Pennsylvania Steel Co., and the Central Construction Co. During World War I, he worked as progress engineer on the construction of the Edgewood Arsenal in Maryland. He rose through many positions with the Pennsylvania Department of Health to his present post of Chief Engineer. He is also Secretary of the Sanitary Water Board.

He is a member of the ASCE, the Society of American Military Engineers, the Federation of Sewage Works Associations, and the Pennsylvania Water Works Operators' Association.

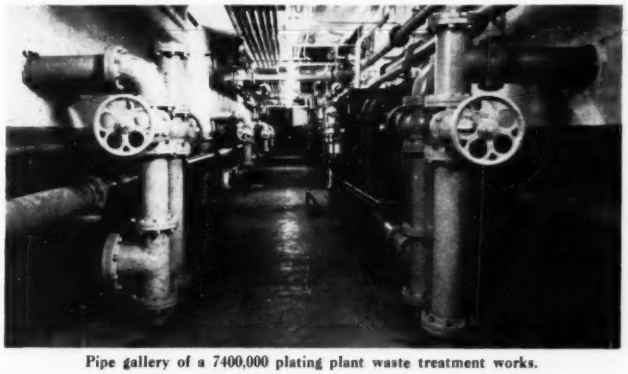
tems which have so improved health conditions in their towns, only to dump their filth upon downstream communities, and with the tremendous development of our industrial age with its wastes of every conceivable kind, we have come to the point where many of our streams have become little more than open sewers. The time has come when this sewage and industrial waste must be treated sufficiently, not only to abate such conditions, but to prevent its interfering with any reasonable use of the stream, without unduly penalizing or injuring either our municipalities or our industries. This requires a full realization that not all of our streams can be brought back to their original state of purity, and that there must inevitably be different classes of streams.

Requirements

The first requirement in stream pollution control is that there shall be a frank recognition of the existing differences in condition of our streams. We must not expect all of our streams to be restored to the point where the stream itself will not have to do part of the work of disposing of waste matter discharged into it; it would not be in the public interest to require this. The first step in any rational program for stream cleanup is to classify the streams according to their present use and condition.

Some ardent advocates of clean streams have strenuously objected to classifying our streams upon the ground that this would be akin to zoning them and that it would inevitably mean holding the polluted streams in their present condition or permitting their further degradation. There should be no basis whatever for this view if classification is used properly, for it is merely a grouping of streams according to their present conditions in order that a logical plan may be developed for upgrading them to their proper use and condition as completely and quickly as practical. As a matter of fact, some state laws either classify certain streams or require the administrator to classify the streams before issuing orders for their protection or improvement.

The second requirement for a successful stream cleanup program is that it be fully recognized that wrong conditions which have developed over many years cannot be corrected at once. There are many reasons for this, but experience shows that despite all reasonable or even harsh enforcement of anti-pollution law, a substantial period will actually elapse between the beginning of a stream cleanup program and its consummation. In reality, pollution abatement is as much a matter of education as it is law enforcement. In this country no law is enforced to a greater extent than that to which the people support it. While it is true that the people now demand that the pollution of the stream above them be abated, it is surprising how many of them feel that they cannot afford to properly treat their own wastes. A campaign of education is the most effective way with which to begin a program of stream improvement.



Pipe gallery of a 7400,000 plating plant waste treatment works.

Costs Substantial

Cost is the third factor involved in pollution abatement. It is important to remember that it costs something—generally a very substantial amount—to treat wastes, and that those who benefit from it will usually pay for it directly or indirectly in the long run. While some enthusiasts have freely claimed that pollution abatement "won't cost a thin dime" because of its offsetting benefits, a considerable time may elapse before the average taxpayer will be able to pay his bill for waste treatment with the savings which he has received from pollution abatement. The costs for the treatment of municipal sewage are in reality just a service charge for preventing the water supply which the taxpayer has fouled by his use from injuring other persons downstream. Just as he finds ways to pay for his gas, electric, telephone, and similar services, so too he must expect and be willing to pay for the proper disposal of his waste water to insure the same abatement of pollution which he rightfully demands from others.

In the case of industry proper, the disposal of its wastes is just as integral a part of the cost of production as are the materials, labor, and overhead which go into the product. Management must recognize this fact. Much can be done by industry to reduce its cost of waste disposal by changes in processes, by cutting down the amounts of liquids used, by preventing leaks and spills and by recycling, by the segregation of concentrated pollutants and the separation of uncontaminated waters, and by other practical measures. Many outstanding examples could be cited of changing a waste into a profitable by-product by a change in operation—even of the by-product becoming the principal product—and in many more instances there can be a "break even" or a partial offsetting of the cost of treatment when proper thought has been given to the matter. When industry applies the same research to waste

(Continued on page 26)

DIVERSITY
OF USES

Aerial Photography

By PROFESSOR DONALD J. BELCHER

Illustrations courtesy the author

From the first fellow who climbed a tree "just to take a look around" to the latest photograph taken from a V-2 rocket, there have been quite a few faltering steps. If wars hadn't come along at frequent intervals, those steps would have been harder to take. Without the airplane, aerial photography was hard work. Captive balloons were used in a limited way in the Civil War, and pigeons, equipped with tiny cameras, flew low altitude reconnaissance missions over World War I trenches. Mathematicians, thinly disguised as surveyors, carried cameras to mountain tops and converted oblique photographs to topographic maps.

Given an airplane that would fly reasonably well, it didn't take the camera-makers long to produce cameras, lenses, films and filters for the real job of aerial surveying. As World War II ack-ack went higher, so did the planes. As the planes went higher, the lenses got longer—until a 20-inch lens became standard equipment. Today an Air Force research program at Boston University has produced a 100-inch lens that can't be carried in just any airplane. In memory of the German 16-inch rifle, "Long Tom", this lens has been fondly dubbed "Peeping Tom."

Two budgets supported aerial photography in this country between wars: topographic mapping by governmental units and the big crop control programs. In the first group of photo-users, there were those who looked at photos and saw contours; in the second, they saw only the number of acres of wheat, corn or tobacco not being raised.

So you can see that one group looked for imaginary lines that weren't there and the other for unplanted corn and unborn pigs. There were those who looked for the things that *were* there but, alas, they were accused of believing in crystal balls and, besides, they had no budget.

Fig. 1.—Land use and related planning and development are symbolized by this oblique view. Gravel deposits and quarry sites can be located directly from aerial photographs.

Uses for Airphotos

Realistically, airphotos are used in many ways. The fields of use divide, roughly, into photogrammetry and photo-analysis. Photogrammetry measures. Photo-analysis does just what the name implies—it analyzes the airphotos for various related purposes. See, for example, figure 1. Airphotos act as a tool or device for any one of a number of fields. But more than that, they act somewhat as a holding company acts to integrate fields of thought and endeavor.

Any one photograph, when *used completely*, can produce a *contour* map, a *soils* map, and a *land use* map. Used by a forester, it can be converted to a *forest inventory* map. A geologist can make a detailed *geologic* map; skilled engineers can locate *dam sites*, identify *rock types* —predict trouble spots. Others can locate likely *oil, uranium, diamonds,* or positive *sand* and *gravel* deposits, as in figure 2.

Farm appraisal, land classification, census-taking, traffic problems, fire-zoning, groundwater re-

sources, and archaelogical studies are all attacked with airphoto-analysis as the first tool. It doesn't usually bridge the gap from problem to answer, but it provides a lot of stepping-stones.

Having said it indirectly, it is now time to come out with the plain statement that airphotos peep into everyone's business—everyone, that is, that deals with the surface of the earth. Viewed stereoscopically —which is the only way to look at them—they form a three-dimensional model of the ground. They show in great detail the trees, bushes, houses and fences—in the dry west they even show ant hills. In many instances throughout the world, they even "show" the size of the soil grains. Day after day people sit right here on the campus and predict the size of the soil grains in an area in Australia, the kind of rock that underlies the soil in a field in Palestine, or the presence of ice in the ground in Alaska.

This isn't entirely an armchair undertaking. The Cornell staff has had an unrivaled chance to get out and learn it on the ground. It isn't always enough to analyze the evidences of soil conditions because they can be misinterpreted. Some of the "signs" change where climates differ greatly from ours. For instance, white patches on the ground may mean sand here, but in arid countries it usually spells salt in the soil.

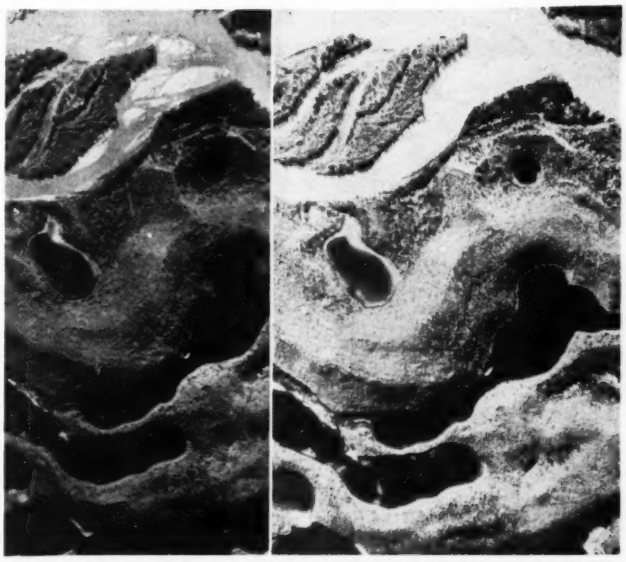


Fig. 2.—This stereo pair shows a gravel deposit existing under heavy tree cover. To look at the photos stereoscopically, place your nose on the edge of a 5-inch cardboard placed vertically between the pair.

Photo-analysis uses land forms as a basic principle. This is simply the fact that formation processes, weathering and erosion give characteristic appearances to different rocks and soils. So, much of the identification is first getting acquainted with the appearance of certain forms. On top of that, the analyst has learned to judge the meaning of various amounts and kinds of surface drainage, soil colors, types of vegetation, various shapes of gullies and many miscellaneous and special features. Many of these are shown in figure 3.

Work At Cornell

The Office of Naval Research, in administering the nation's basic science program, offered assistance to the University in furthering the development of this work. Since 1948 the staff at Lincoln Hall has grown both in number and experience. With three years of field work behind them, they have investigated the basic identification factors in Alaska, Japan, Africa, Europe, the Pacific Islands, Puerto Rico and in most of the States and Canada.

In working with airphotos, in the lab and in the field, the inter-relation of vegetation, soils, moisture, erosion, prosperity and an infinite number of other things is driven

(*Concluded on page* 22)

THE AUTHOR

Professor Donald J. Belcher is the Head of the Department of Transportation Engineering in Cornell's C.E. School and Director of The Cornell Center for Integrated Photographic Studies. He is also the director of two research projects: a Navy airphoto program and a Civil Aeronautics Administration development program using radioactive materials to measure soil moisture and density. He also heads a private firm, D. J. Belcher & Associates, that engages in photo-mapping of various types and is a consultant for several government agencies.

Professor Belcher developed the original applications of engineering photo-analysis while at Purdue University. During the war he was a civilian consultant on the Joint Staff in the Southwest Pacific area. He came to Cornell in 1946.

Professor Belcher

PROMINENT

Dick

Richard L. Freeman, ME

If you can get him to stop bouncing around, you can get to talk to him. For during the fall football season and the winter basketball season, Dick puts everything he's got into cheering the team on as one of the dazzling Cornell cheerleaders.

Wanting a sound education and technical background, Dick came to Cornell from Schenectady, N.Y., and took the course that would afford him what he was looking for, the course in Mechanical Engineering. His fifth year project is involved with the Administrative Engineering Department, where he is part of a group doing the development and planning preparatory to the production of a new machine. He feels that the project work is helping him to work with people, which he wants to do after graduation, and also ties together all the work of engineering that he has done in the four years since he came to Corneli in 1946.

Feeling that an engineer has definite responsibilities to his community, Dick has devoted much time to the cause of increasing school spirit. Besides his work with the Cheer-Leaders, he is active in the Student Council Rally Committee, and has helped to establish the Engineer's Lounge in Sibley. He won his letter in JV crew in 1950, and is a member of the Crew Club. His most prominent position in Sibley is the chairmanship of ASME.

In recognition of his activities, Dick has been elected to Kappa Tau Chi, honorary fraternity in Administrative Engineering, of which he serves as treasurer and vice-president. He is also a member of Pi Tau Sigma, honorary M.E. fraternity, and secretary of his own social fraternity, Alpha Sigma Phi.

Dick's other extra-curricular activities include an indiscriminate passion for records that enables him to buy a Bach fugue and *Twelfth Street Stomp* at the same time with perfect ease. He plays the piano, and likes to get together with "the boys" once in a while and "make the Welkin ring."

Dick has spent his summers in the construction business starting from the bottom up — digging ditches. He feels that there is room for better methods in the construction trades, and may devote his energies to that industry. He is interested in administrative work in which he will be working with people, possibly combining both aspirations by improving industrial relations in the construction field. Then again, he would like to go to business school. If Dick can apply the same technique to the future that he has followed in work and activities on the Hill, he is due to revolutionize something.

Theodore J. Holmes, EE

Utica's contribution to this year's senior class in electrical engineering is Ted Holmes, who, unlike so many of his immediate predecessors, came to Cornell directly, without military service. He describes his high school as a small but efficient institution; and, through its well presented science and mathematics courses, the seeds of engineering interest were first sown. It did not take them long to grow, as Ted decided immediately upon graduation that some engineering school would be his next step.

It was not so easy for him to decide, however, just which branch of engineering held the highest potentialities for him. After long and concentrated consideration (and a flip of a coin), Ted finally decided on the Cornell School of Electrical Engineering, a decision which he has not had occasion to regret.

Here at Cornell, Ted followed the wise course of keeping his extra-curricular activity at a reasonable minimum during his first year, while establishing himself on good terms with the devious machinations of math, physics, and chemistry. He had joined the Music Club and the Independent Council, but his membership he recalls as "passive."

By his junior year, however, Ted was ready to dip his finger into the extra-curricular pie, and he pulled out some choice plums in the E.E. school. This year, while following his chosen option of industrial electronics, he has acquired the responsibility of a number of offices in these organizations. Eta Kappa Nu claims him as its president; and he is also vice-chairman of the student branch of the AIEE, as well as secretary-treasurer of the Student Engineering Council. Along somewhat less professional lines, Ted also holds membership in Scabbard & Blade, and the Delta Club.

Ted

ENGINEERS

Ted describes Cornell in general as a "Utopia," but cites the E.E. school in particular for its closeness of student and faculty. When he graduates, he plans to get into some form of general motor control work. However, there is a rumor circulating that Uncle Sam may have some feelings in the matter of post-graduation plans, especially in view of Ted's ROTC-earned reserve commission in the Officers' Reserve Corps.

Norman F. Kirchner, CE

Call him Norm if you will, but his accomplishments are considerably above the normal. Those in the C.E. School know him well as a prominent member of its scholastic and social organizations. In addition to holding several past offices in these societies, he is now president of the C.E. honor society, Chi Epsilon, and treasurer of Tau Beta Pi.

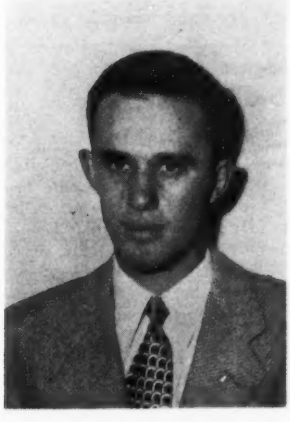
Coming from Buffalo Tech four years ago, Norm found C.E. quite natural, for after all it is his father's and grandfather's profession. His preference for practical work over research also led him to civil engineering and from there into his specialty, Structures.

The glorified view of Structures —building bridges and skyscrapers —does not mislead him because he has seen the practical side in summer work. During two summers he did field work in the concern with which his father is associated. Last summer he, along with another C.E., had an unusual opportunity. The two were employed to design several buildings with little supervision. Evidently, they successfully designed a high school, now being constructed, and a Y.W.C.A. building, about which no comments are forthcoming.

Although a part-time job under Professor Lewis in the Highways Laboratory will claim most of his spare time this year, there are other activities to squeeze into the leisure hours. He played for several intramural teams in basketball and football and even tried track, but his sport for the moment is golf. The scores naturally are secret. Now he is an active member of the C.E. social organization, Rod and

(*Concluded on page* 31)

Norm



William C. Brasie, ChE

Straight down from the Canadian North Woods has come William C. Brasie to the School of Chemical Engineering. Actually, Bill's home town is Flint, Michigan, but his love of the outdoors has led him on several canoe trips into Canada. The last one took him about 250 miles north of the Canadian Soo. the last 80 miles by portage and paddling, to a place where the fish were so plentiful that he and his friends caught 90 pounds of northern pike in three hours, including a 28 pounder.

Here at Cornell he has continued this hobby through the Outing Club, and is also a charter member of the Cornell Grotto of the National Speleological Society, a group of enthusiasts who seek and find

Bill

pleasure in crawling around in dark. damp, dank, bat-infested caves.

Bill also enjoys rowing, and has been on the 150 pound crew for four years now, winning two JV letters, in addition to three varsity letters he earned with the rifle team. And just to keep limbered up between season, he plays baskebtall and bowls with his house team of Alpha Chi Sigma, and shoots with the pistol team.

All these activities left Bill with plenty of free time in which to be president of the local AIChemE branch, secretary and treasurer of the Cornell Railroad Club, to hold the purse strings of the famous ChemE and Chemists "fellowship group," Al-djebar, and to be erstwhile assistant scoutmaster of Troop 4, Ithaca.

Bill fills out the rest of his time by going to classes. Now in his fifth year, Bill is working on his project, a continuous salt crystallizer, but is having slight difficulties — it doesn't seem to run. But he's sure that he will iron out these operational difficulties before graduation.

In attest to his being on Dean's list for four years, Bill holds a McMullen scholarship, and is now top man in his class. Both Pros-Ops and Tau Beta Pi have elected him to membership.

Last summer Bill worked as a research assistant in an oil refinery, looking for a new method of controlling the sulfur in petroleum products. Although he has no definite plans, he hopes to continue in research and pilot plant development after graduation.

Techni-Briefs

Zeset Textile Finish

A textile finish that will impart durable wrinkle resistance and shrink resistance to cotton and viscose rayon fabrics has been developed and placed on the market. It has been trade-marked "Zeset."

When treated with "Zeset," spun viscose rayon fabrics may be laundered and bleached under the usual home conditions without serious loss of strength and discoloration frequently encountered. In addition, "Zeset" imparts a soft, wooly finish to the fibers, rather than the harsher finishes produced by other agents.

It imparts a degree of shrink resistance to viscose rayon impossible with other types, and its development is expected to enlarge the wash goods field for manufacturers of spun rayon fabrics.

An outstanding feature of the new finish is the ease with which the textile processor may apply it, and this eliminates many of the problems formerly associated with the application of crease-resisting and stabilizing materials.

"Zeset" can be applied in any plant where padding, drying, heat treating and washing equipment are already used in applying thermosetting resins. It is stable during storage, and can be diluted with water.

The new finish may lend itself for use with linen and pile fabrics, such as transparent velvets. While most viscose rayon fabrics are admirably suited to treatment with "Zeset," cotton fabrics must be selected with care. Best results with cotton fabrics have been with combed and mercerized yarns.

Resin Coating Intermediate

A new baking-type coating intermediate, designated as R-108, and combining outstanding chemical resistance with flexibility and heat resistance, has been developed by G.E.'s chemical department.

Based on selected phenol derivatives, R-108 is compatible with a variety of coating resins. Protective coatings formulated with R-108 possess remarkable resistance to alkalies, acids, oxidizing agents, solvents, salts, and other corrosive chemicals over a wide temperature range; extreme toughness, flexibility, and resistance to abrasion; and unusual stability to ageing at elevated temperatures.

Coatings formulated with R-108 may be pigmented in a wide variety of colors and are easy to handle and apply. Standard equipment and conventional techniques may be used for applying and baking these new coatings.

Designed to permit formulation of coatings that combine the outstanding properties of both vinyl and conventional phenolic coatings, R-108 is being produced on a semi-commercial basis and is available in drum and tank-car lots. It is anticipated that this new intermediate will play an important role as a raw material for the protective coatings industry. Field tests now being conducted show that the unusual properties of R-108 make it especially useful in coatings for drums, food containers, tank cars, chemical tanks and process equipment, and appliances.

Modern Traffic Control

The City of Denver, Colorado, has recently modernized its entire downtown network of traffic signals and controllers, eliminating all manual adjustments and human guesswork in timing signals to handle irregular traffic fluctuations.

The initial installation includes 104 General Electric Type F traffic controllers supervised electronically by a master cycle selector.

Every six minutes, the electronic master selector will add up the traffic count, compute the proper timing cycle and red-green splits to handle the traffic flow, and then automatically adjust the 104 individual controllers by varying the voltage and frequency on their synchronous drive motors. Adjustments of the cycles are limited to five-second increments every six minutes to avoid sudden large changes in cycle timing.

Offsets on the controller dial units also can favor traffic entering the downtown section during the morning rush hours and outgoing traffic in the evening. In addition, percentage splits of red and green can automatically reverse between main and side streets as traffic flow dictates. Thus, completely automatic traffic control is provided at all times regardless of traffic fluctuations caused by storms, movie rush hours, parades, etc.

A pedestrian walk period with traffic stopped and pedestrians moving in all directions is also provided by the new system. As vehicular traffic demands a longer timing period, the same demand will be reflected and compensated for in the pedestrian walk period.

Magnesium Alloys

Magnesium alloys, because of their lightness—about two-thirds that of aluminum—high strength-to-weight ratio, easy machinability, and good weldability, are being used to an increasing extent in the fabrication of electronic equipment, ladders, aircraft parts, portable gangplanks, auto trailers, and numerous other articles. While commercial magnesium alloys are usually resistant to ordinary kinds of atmospheric corrosion, they may corrode seriously in certain industrial atmospheres or along the sea

coast, especially if they are in direct contact with salt water. To learn more about the suitability of these materials for aircraft use, H. L. Logan and H. Hessing of the National Bureau of Standards, at the request of the Bureau of Aeronautics, Department of the Navy, have conducted an extensive investigation of the resistance of wrought magnesium alloys to corrosion under stress both in a marine atmosphere and an inland atmosphere.

The specimens were exposed to the weather stressed in tension at the National Bureau of Standards in Washington and on a platform built out over the tidewater so that they were exposed in a marine atmosphere at Hampton Roads, Virginia. Unstressed specimens were subjected to the same corrosive conditions in order that the effect of stress in increasing corrosion damage could be evaluated. Laboratory tests were also made by continuous immersion of stressed specimens in a sodium chloride-potassium chromate solution and by intermittent immersion in a 0.01-per cent sodium chloride solution.

For the intermittent immersion tests, the corroding solution was raised into cells surrounding stressed specimens wetting the specimens four times per hour. Breaking of a specimen under stress automatically opened a knife switch in the circuit of a solenoid counter actuated once every six minutes by a clock. "Threshold" stresses, defined as the maximum stresses that materials can withstand without failure when continuously immersed in the corroding medium for a fixed period of time, were determined as a measure of corrosion resistance in the sodium chloride-potassium chromate solution. Resistances to stress corrosion in intermittent immersion and weather exposure tests were evaluated from exposure periods to failure at given stresses.

In general, the susceptibility of magnesium alloys to stress corrosion in the weather increased with aluminum content up to about 6.5 percent of aluminum. It was found that the specimens stressed at the Washington (D.C.) weather exposure site failed in shorter periods of time than those exposed to the same stress in a marine atmosphere. On the other hand, damage to unstressed specimens at the Washington site was small as measured by losses in tensile properties.

Engine Corrosion Reduced

According to records supplied by service stations, 60 percent of automotive engine wear can be attributed to corrosion. The postwar trend in the industry of electroplating cylinder liners, pistons, rings and other engine parts with porous chromium and tin is reducing wear from corrosion and abrasion more than 30 percent, according to a report recently received by the American Electroplaters' Society.

Fluorescent Streetlights

The nation's first fluorescent street-lighting system was placed in operation by the Detroit Public Lighting Commission recently. Instead of the conventional globes, the new "white-way" uses giant, eight-foot-long, tubular fixtures, developed by engineers of the General Electric Company.

The fixtures are aluminum tubes in which two pairs of equally-long fluorescent lamps are mounted. Two scientifically-designed reflectors, mounted back to back in each tube, direct light from these lamps through clear plastic windows to the street.

The system is installed along a half-mile segment with a total of 24 fixtures extending out from the curb on either side of the street.

Collectively, the four fluorescent lamps in each fixture produce approximately 19,000 lumens of light and provide an average lighting level on the street of about one foot-candle. This is adequate for heavy pedestrian and vehicular traffic, because of the fluorescent lighting's uniformity of illumination.

The fixtures are mounted 25 feet high on wood poles spaced at intervals ranging from 100 feet to 140 feet.

Torpedo Behavior Recorded

Navy scientists are using high-speed motion picture cameras set up on torpedo ranges at the Morris Dam reservoir in San Gabriel Canyon, near Pasadena, California, to record accurately the behavior of projectiles being tested. A variable-angle pneumatic launcher fires projectiles into the water, and as many as seven cameras record their courses.

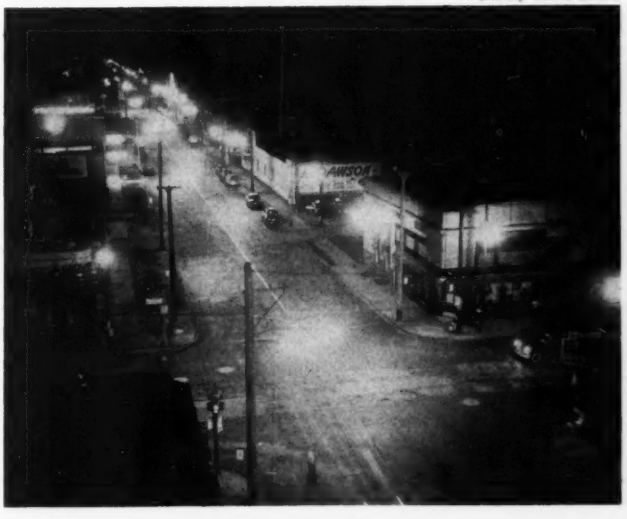
Special motion pictures studies of the impact of missiles with the water are made with high-speed cameras at speeds as high as 1,200 frames per second. Study of the results provides valuable data for improving torpedo design.

A 35-mm motion picture camera and a specially-constructed "flare"

(Concluded on page 31)

First flourescent street-lighting system.

—Courtesy General Electric



Cornell Society of Engineers

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George T. Minasian

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."

President's Message

Back in 1918 after three years of math, science and engineering, potential Cornell engineers picked up their copies of Ely at the Co-op and launched briefly into economics. It was surprising how quickly this broadened their conversational acceptability among their non-technical brethren. Private enterprise, monopoly, wealth and value, supply and demand, profits, organized labor, etc., supplied unlimited material for "bull sessions."

I recall being impressed by the fact that the Law of Supply and Demand was not nearly as simple as I had imagined. However, it was not until I began earning a living that I fully realized that an engineer was a commodity and his "market value" was indeed subject to supply and demand. Moreover, whereas most commodities can be turned out in rather short order, it generally takes at least four years to produce an engineer.

It is this time factor that seems to get the demand for engineering graduates out of phase with the supply. When the technical lads are doing well, their young brothers and friends rush to get aboard. But when engineering jobs are harder to find, Junior looks elsewhere, although four years later the situation may be entirely reversed.

Today it seems that most everyone must be aware that this country is short of engineers, and with low enrollments and military needs this shortage will grow during the next four years.

Unfortunately most of us did not foresee this condition. In fact until a short time ago, government officials, industry and many educators were still worried about a surplus of engineers.

It was over a year ago when the engineering colleges of the country were about to graduate a record of 50,000 engineers that I met Dean Hollister at the Cornell Club. To my amazement he said as nearly as I can remember, "We not only can absorb our engineering graduates, but are headed for a severe shortage." This, mind you, over a year ago.

"Holly" has played a leading role in bringing the seriousness of this situation to the attention of the Nation and its leaders. My hope in this message is to urge Cornell Engineers to do their part to stimulate the interest of high school students in an engineering career.

It is my own sincere conviction that a student interested and able enough, to be accepted by the Engineering College at Cornell, will never regret his choice. A Cornell Engineering Degree will be a valuable asset regardless of whether he stays in the engineering field.

GEORGE T. MINASIAN

EDITORIAL

As we seniors move farther along in our fifth year, we can see the final shaping-up and finishing of our undergraduate training taking place. All the basic courses we took long ago are being integrated into a coherent whole, and advanced courses of the most practical nature are opening our eyes to new fields of study and research which we have not previously considered, but which can be mastered with the background training we now possess. For those of us who are working on fifth-year projects, the feeling is prevalent that we are now winding up our basic engineering training in a most realistic and practical way.

This final integration of past training has really given us a more complete realization of the enviable place which the engineer holds in society. It is the engineer who designs and creates all manner of devices to improve the general lot of mankind. With the more enlightened thinking of today's national leaders, it is for the first time conceivable that prosperous and highly-industrialized nations like our own may take unselfish, positive action to spread the benefits and conveniences of our economy to the unfortunate areas of the world which still languish in poverty and backwardness. The Point Four program which President Truman has proposed would be the first step in this direction. In any such worldwide program of industrial expansion and public works construction, American engineers would take the lead to make the universal dream of a better living for all men come to life as a carefully-thought-out program which could be actually accomplished.

It is therefore with the greatest feeling of sadness and futility that we see the specter of another catastrophic war looming up before us. Those of us who will soon actively enter the engineering profession are faced with a complete perversion of all our fine training. Should war come, we must create instruments for the destruction of mankind instead of producing those things which would give man a better life. Our motto must become "a bullet for every enemy" instead of "a car for every garage." But such is the terrible price we must pay if we are to protect the free enterprise and democratic government system which has made possible the great industrial progress on which our national wealth and prosperity depends. The engineering profession will be ready to devote its talent and ingenuity to the production of arms for our nation's defense when the occasion arises.

There is still hope that the prayers of the world will be answered, and that by some miracle the third world war will be averted. The forthright action of the United Nations so far in expending every effort to arrive at peaceful solutions of problems between nations, even after actual warfare has broken out, is something to give us hope that a better understanding between the free and the communist worlds may be reached. If such is the case, a bright future in the engineering profession is assured for all those currently in school, and for many more, because the present rapid expansion of the country's industrial capacity is causing a far greater demand for engineers than can possibly be met by graduations at the present rate.

Members of this year's senior class must now plan their futures and accept positions in industry with the fervent hope that war will not come, and that they will be able to practice their profession in peaceful endeavors. But should the worst happen, the excellent training we have received at Cornell will prove just as valuable in work for the nation's defense as it would have been in providing for everyone the benefits of peacetime production.

T.J.K.

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College News

New Materials Laboratory

A $1,700,000 laboratory for the study of materials and methods of processing them will become the second unit in Cornell University's new engineering development. A building contract has been awarded to the White Construction Company of New York, and Cornell workmen have begun preparation of the site. Construction will begin as soon as conditions permit, and the building is scheduled to be completed sometime in 1952.

Dr. de Kiewiet, acting president of the University, stated that the fact that building conditions favored starting construction now rather than later influenced the trustee's decision to proceed. A substantial portion of the funds is available from the engineering development program, and plans are being made for obtaining additional gifts to meet the remaining amount.

The center, consisting of two adjoining units, a Materials Laboratory and a Materials Processing Laboratory, will be constructed on a site in what is now woods on the edge of Cascadilla Gorge opposite the temporary buildings on Campus Road. A part of the old heating plant will be removed to provide room for the structure.

The building will be constructed of red brick, limestone and native stone and will contain 1,300,000 cubic feet of space. It will have an overall length of 245 feet and a depth of 135 feet.

An unusual bay for research in structures will be a feature of the Materials Laboratory. The main floor of the bay will be large enough to permit load experiments on a 90-foot, two-lane highway bridge.

The Materials Laboratory will house the Departments of Mechanics and Engineering Materials and will contain some of the laboratories of the Department of Engineering Physics. Special facilities will be provided for research in photo-elasticity and other methods of experimental stress analysis and for spectroscopy and radiography.

The other unit will house the Materials Processing Department of Sibley School of Mechanical Engineering and will have facilities for research in machine tool production methods, the machining of metals and the development of plant layouts for manufacturing purposes.

The laboratories are part of an engineering development program prepared in 1940 which proposes the construction of a building for the School of Civil Engineering on the site of the present Diesel Laboratory and Old Armory, one for the Sibley School of Mechanical Engineering on the present site of the School of Industrial and Labor Relations and another for the School of Electrical Engineering on the site of the houses between the School of Industrial and Labor Relations and Hoy Field.

Olin Hall, housing the School of Chemical and Metallurgical Engineering, was opened in 1942 as the first unit of the development. The building was a gift of Franklin W. Olin, a Cornell engineering graduate of the class of 1886.

A view of the new Materials laboratory from Sage Green.
—Courtesy Cornell University

Engineering Council

As its first major project this term, the Student Engineering Council is inaugurating a committee system to allow more students to participate in the extra-curricular program. In line with the Council's objective of co-ordinating activities throughout the Engineering College, various committees will be set up to handle these events and plan such college-wide functions as the Slide Rule Capers, Engineers' Day, Engineers' Banquet, etc. The committee members will be drawn from general sign-ups, the committee chairman being selected from the Council.

The committees to be formed are as follows: Co-ordinating, Publicity, Slide Rule Capers, Engineers' Day, Engineers' Banquet, and Engineering Smokers.

Earlier this term, the Engineering Council had been working on revis-

(Continued on page 28)

Drill Night

From a point high on the campus, a radar beam searches the sky. Lights burn in classrooms. Khaki replaces tweed and covert for the night as college men assigned to Reserve units study the machines and methods of defense.

Preparedness is the order of the day.

And the Bell System stands prepared. In five busy years, we have added more than 12,500,000 telephones. Many improvements have been made in the quality and speed of service. Our force of highly skilled, experienced men and women has been greatly enlarged—and now numbers more than 600,000.

A nation in a hurry goes by telephone. This country has the best telephone service in the world.

BELL TELEPHONE SYSTEM

Alumni News

William G. Hoyt, C.E. '09, resigned October 14, as executive officer and vice-chairman of the water resources committee in the U.S. Department of the Interior. The previous day, he received the Department gold medal with a citation for distinguished service. Entering the U.S. Geological Survey as a junior engineer, he became district engineer in charge of steam gauging in the Upper Mississippi District. In 1921 he undertook surveys of water utilization problems of the public domain.

Robert G. Clark, M.E. '22, was elected a director of Utah Oil Refining Co., Salt Lake City, in April. He had been chief engineer for more than twenty-five years and was made refinery manager in October, 1949.

David E. Brainard, E.E. '23, is division engineer of the salient pole generating and converting division in the Schenectady large motor and generator engineering division of the General Electric apparatus department. His address is 1334 Myron Street, Schenectady.

Thomas W. Pew, M.E. '26, was elected to the Board of Trustees of the University on October 20. Trustee Pew is president of General Crude Oil Co. of Houston, Texas, and a director of the Independent Petroleum Association of America and of the Second National Bank in Houston. He is regional chairman of the Greater Cornell Fund campaign for Texas, Louisiana, Oklahoma, and Arkansas. He is a member of the Cornell Society of Engineers, American Petroleum Institute, American Institute of Mining & Metallurgical Engineers, and Texas Society of Professional Engineers; is on the executive board of Boy Scouts of America and a former board member of Transcontinental and Western Air, Inc. While at Cornell he was elected to Atmos, Red Key, and the Senior Ball Committee and was a member of Chi Psi and Beth L'Amed.

Nathaniel A. Owings, B.Arch. '27, was appointed, October 9, a trustee of Illinois Institute of Technology. He is a partner in the firm of Skidmore, Owings & Merrill

Nathaniel A. Owings

which designed Savage Hall and Floyd Newman Laboratory of Nuclear Studies. Mr. Owings is a fellow of the American Institute of Architects and director of its executive committee. He lives at 1240 North State Street, Chicago, Ill.

J. Vernon Ashworth, M.E. '36, engineer with U.S. Steel Export Co., New York City, spent six weeks in Buenos Aires, Argentina, and a week in Rio de Janeiro this summer on a business trip. An article in the Nutley (N.J.) Sun described his experiences, including a military parade in Buenos Aires and an emergency landing in Bermuda on his return trip. He lives at 32 Coeyman Avenue, Nutley, N.J.

Whitman J. Severinghous, M.E. '40, '41, returned from the Union of South Africa where he spent two and a half years gathering material for the Institute of Current World Affairs. He talked with all sorts of people from Bantu tribesmen to the late ex-Premier Jan Smuts. He and Mrs. Severinghous **(Sarah Claasen, '41)** live at 509 East Buffalo St., Ithaca.

A. Yates Dowell, Jr., B.M.E. '42, who received the L.L.B. at Georgetown University and was admitted to the District of Columbia Bar, May 5, is in partnership with his father in the District of Columbia. The firm specializes in patents, copyrights, trademarks, and unfair competition cases. The Dowells live in Langley Forest, McLean, Va., and have three children.

Edward J. Kendrick, B.C.E. '43, '46, with Barker & Wheeler, Engineers, Albany, is resident engineer for all work in Suffolk County; the firm acts as consulting engineers to the County Water Authority. He lives at 30 Fairview Street, Huntington, N.Y.

Richard L. M. Rice, B.S. A.E.(M.E.) '43, has moved from Dallas, Texas to Wilmington, Del., where he works in the management engineering section of the DuPont engineering department. He lives at 1246 Riverside Drive, Wilmington.

Roger S. Chamberlain, B.ChemE. '46, '50, is in the chemical engineering department of Dow Chemical Co. at Freeport, Texas. His address is 1127 West Broad Street, Freeport.

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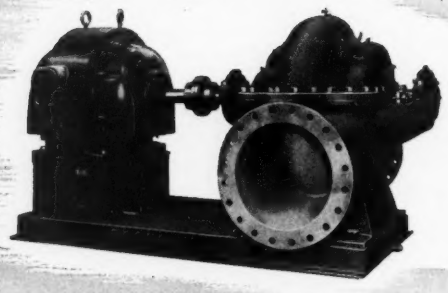

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Aerial Photography

(*Continued from page* 11)

home. This obvious relationship has had a strong influence on specialized workers and students. The use of photographs gives reality to the sometimes abstract business of preparing plans. Plans drawn on paper often ignore the effect that their execution will have on the surrounding area.

Expansion of Uses

Today, the use of aerial photography is expanding to all parts of the world. Area development programs and large-scale prospecting for new mineral deposits are great stimulants to wider usage. To train personnel properly, Cornell University has met the broad usage of aerial photography squarely. Rather than piecemeal training, it has integrated all of the uses of aerial photography within the University into a flexible unit—The Cornell Center for Integrated Aerial Photographic Studies. This Center provides basic training in photogrammetry, photo-analysis, and cartography. It presents specialized studies in several divisions of agriculture—soil surveying, land classification, and forestry. Geologic mapping and related geologic studies are tied in to prospecting for mineral resources and engineering works.

Training Prerequisites

To begin with, a student needs little more than two good eyes as a prerequisite to the basic courses. One product of the program sponsored by the Navy has been the simplification of teaching methods. The last war brought out a paradox in this respect. Young men were too young to have had sufficient field and airphoto experience; old men with field experience were too old to know much about "reading" the pictures. Only a few years ago —and even now, in some places— the prerequisites for such studies are ". . . degrees in geology, soils mechanics, or an equivalent." The Cornell method is designed to teach *people* to use aerial photographs and not to create a group of specialists.

The fundamentals of geology that underlie rock and soil formation are embodied in "keys" or charts that help a novice to select and eliminate land forms. Examining the photographs steroscopically, an area is identified by a three-step process. Two charts, one dealing with *level* ground and one with *hilly* and *mountainous* areas, are available for use. If a level area is to be identified, the proper chart is used. On it, by a selective process, the proper identification narrows down to one or two land forms. For each land form—and there are 35 of them—there is a folio of information describing and illustrating the particular land form. Examining the land form selected from the chart permits the student to compare its features with that in his photograph.

The Cornell staff has these in final draft form. Soon the entire series of folios will be complete and there will be available an encyclopedia of land forms that has never been approached in scope.

BOOK REVIEW

ELECTRONICS IN ENGINEERING, by W. Ryland Hill. 274 pp. McGraw-Hill Book Company.

This book was written as a text for a course in electronics for non-electrical engineering majors, and as such it fills a definite need. Many texts on electronics have been published, but for the non-electrical engineer they all suffer from one of two defects. Either they are too long and too theoretical to make it possible to cover the book in a reasonable length of time, or they read much like a handbook as a result of the author's desire to produce a short book which includes enough material to give it wide appeal. *Electronics in Engineering* seems to me to be a pleasant compromise, written in a very readable style.

No background in electronics is assumed, but the reader must be familiar with basic electric circuit theory. A knowledge of Ohm's Law, Kirchoff's Laws, and the behavior of resistance, capacitance, and inductance in simple circuits is sufficient.

About one-third of the book is devoted to discussion of the characteristics of the various high-vacuum and gas-filled tubes which are in common use. This is necessarily brief but sufficiently adequate to give a qualitative understanding of the function of these tubes in practical circuits. The remainder of the book deals with applications of these tubes and includes, in addition to the standard material on rectifiers, filters, amplifiers and oscillators, several chapters which may be omitted, if desired, without interrupting the continuity.

For the most part, the various applications are introduced as soon as the reader has been prepared for them. For instance, a chapter on single-phase rectifiers immediately follows one on rectifier tubes. This arrangement, which is in contrast to the more common scheme of disposing of all tube characteristics before mentioning any applications, contributes much to the continuity and makes the book more adaptable for use with a course which includes laboratory work.

Throughout the book the emphasis is directed toward gaining an understanding of the possible uses of electron tubes. Rather than attempting to explain any specific complicated control equipment, the author stresses the operating characteristics of the amplifiers, grid-controlled rectifiers, and other components which might go to make up such a piece of equipment. The broad coverage of fundamentals and the freedom from specialization should make it a valuable text for one majoring in any of the sciences or engineering, who would like to learn the possible application of electronics to his problems.

The book might be of even greater value to the non-electrical engineer if it included a bibliography of some sort.

N. H. Bryant,
Asst. Professor of Electrical Engineering

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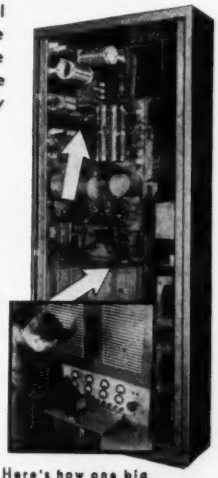

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Engineering Shortage

(*Continued from page 6*)

counselors, and the high school students themselves with the shortage and consequent need of engineers in all categories. It is vital to our security and welfare that such information reach these persons.

What is significant to industry in the picture here set forth? It means that there will not be young replacements for engineering jobs vacated by the calling of reservists or of draftees. There will be only a partial supply of young engineers for new jobs as conversion, re-tooling and war production may require. Inter-company pirating will only add to the diffiffculties of staffing. Robbing the colleges of faculty members for industrial jobs will surely dry up the supply, and reduce the quality of training given by the colleges.

Streamline Industry

It will be essential for industry to re-examine the functions of the engineering personnel and to make certain that each engineer is being used in the most effective manner possible. No engineer should be used in positions others can occupy as well. Supporting personnel, requiring less training and experience, should be used to spread as far as possible the effectiveness of each engineer.

Even competent supporting personnel will be tight. It will be necessary to begin in-service training of such personnel, and to engage women as far as possible. The training programs of the last war will need to be re-established. None of these steps can be put off. The organization of industries must be streamlined now.

Government Planning

Government agencies, including the armed forces must take cognizance of the situation. Plans must be developed whereby the engineering manpower needs of the services and of industry may be so coordinated that both will be appropriately served from the limited supply. Industry has the job of supporting the military. To assume that the military needs are paramount or exclusive would be a form of national suicide. A careful planning for utilization of men with engineering training and experience only in categories where such training and experience are mandatory should be undertaken; although such can probably not be wholly achieved, it is in the interest of the total effort that such an objective be approached as nearly as possible. Sound policies relating to deferment and the calling of reservists must be promulgated with the objective of maintaining a balanced utilization.

It is reported in the technical press that the Russians in their current five-year plan are scheduled to have produced 150,000 engineering graduates by the end of 1950. This matches our own output for the same period. During the next five years, however, we will drop by one-third unless drastic action is taken to increase the supply of engineering freshmen and to continue the training operation in full force.

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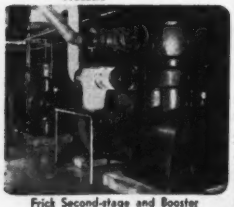

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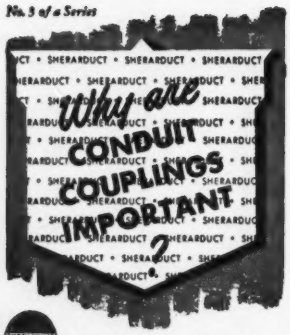

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Pollution Control

(Continued from page 9)

disposal that it has given to the improvement of its product, it will be surprised by the additional instances of profitable by-products. However, for most industrial wastes for a long time to come, treatment will be a direct additional cost of production. Because of this, nothing unreasonable or inequitable should be demanded of industry in the treatment of its wastes. This is particularly true when the industry is of the "low profit" type in competition with similar mills in states which do not require treatment of wastes.

Now what have the people a right to expect from a stream clean-up program in a state which gives its administrators adequate authority to control pollution? The clean-up agency will have authority over all surface and underground waters, streams, lakes, ponds, and dammed bodies of waters, whether publicly or privately owned. It will also have authority to determine what constitutes pollution, which is usually construed to mean "any noxious or deleterious substance rendering unclean the waters to the extent of being harmful or inimical to the public health, or to animal or aquatic life, or to the use of the waters for domestic water supply, or for industrial purposes, or for recreation." It will have authority over the discharge of sewage and over every kind of industral wastes by any person, industry, institution, or municipality.

Expectations of Public

In return for such a grant of power, the public has a right to expect that the law will be vigorously administered in accordance with its terms, with wise discretion and with even-handed justice. It has no right to expect that wrong conditions will be corrected in less than a reasonable time when all the factors involved in each individual case are fairly considered, nor that where practical methods for pollution abatement are not yet known, that a reasonable time shall not be allowed in which to expeditiously seek the answer.

The people have the right to expect that, within a reasonable time, all their streams will be cleaned up to the extent consistent with the best public use for each class of streams. They have a right also to expect that their now clean streams shall be kept clean. This involves two different viewpoints. One is that wastes discharged to them shall first be treated only to the extent that the stream can assimilate them and still remain clean. The other viewpoint is that such wastes should be given complete treatment—that is, the removal of practically all suspended solids and at least 85% of organic pollution, or at least treatment to the maximum extent practical. The first plan utilizes the assimilating power of the stream to reduce costs, but requires that the degree of treatment necessary must be re-appraised after each major change in conditions. The second plan is the more conservative, but often somewhat more costly; it will probably grow in acceptance, and is now more or less mandatory under at least one state's laws.

Degree of Treatment

The degree of treatment required must be determined with sound judgment and equality—not only for each stream, but for each reach of the stream in accordance with the best interests of the public. At times, this may require the wisdom of a Solomon. There are those who insist that the condition of the receiving stream is the sole criterion and that it should be permissible to discharge anything to it so long as it remains healthy enough for its class. Of course, the condition of the stream is the final criterion and represents the integration of all the factors affecting it, but as a yardstick for the practical administration of anti-pollution law, stream standards leave much to be desired. There is the time and effort required to get representative values of "before" and "after" conditions at each point of discharge, of being able to prove the load and its effect placed upon the stream by each discharge; and, finally, there is the need, in the end, to specify the degree of treatment for each discharge, and, of real importance, the need to re-evaluate requirements

(Concluded on next page)

Pollution Control

(*Continued from page 26*)

with each major change in the quantity or character of wastes, or in the case of new discharges.

On the other hand, the wastes discharged to a stream can be readily identified, measured, and analyzed, and the necessary degree of treatment, through effluent standards, can be reasonably well determined in accordance with an overall policy. Perhaps "stream standards" applied through the classification of the streams and "effluent standards" applied to the wastes within each class of streams may be the best method under some laws, but, by any method, the most important requirement of all is the wise, sympathetic, and impartial administration of the law.

Picture for Future

With such administration, and with the program of stream cleanup properly attuned to the needs of the day, the people can look forward with assurance to the time when our streams will be truly conserved—restored to their best uses at the minimum cost and least disturbance to all interests. Whether the cleanup shall be by abating the pollution in accordance with the urgency of each case, by stream basins, on a state-wide basis, or by some combination of these, and whether some construction should be reserved for the time when there is a great need for public works to offset unemployment, are all questions to be determined according to the conditions within the state concerned. In any event, the ideal plan must inevitably be wisely modified by the interaction of the many factors involved in such a major undertaking if it is to be done to the best interest of all.

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College News

(*Continued from page* 18)

ing its Constitution. The Slide Rule Capers had been scheduled for a date in November, but due to conflicts at the Straight, it was postponed until February 17.

Slide Rule Classes

Once again Tau Beta Pi conducted a series of classes on the use of the slide rule for novice engineers. Starting on November 30, the classes were held for three consecutive weeks in two separate sessions, one on Thursday evenings and the other on Friday evenings. The lectures were given by Dave Marsland, ChemE '51, while Stan Taylor and Bob Caplan, also of the same class, assisted the thirty-five students present at each session in learning to operate their slipsticks. At the first lecture, the basic operations of multiplication and division were explained, while later sessions took up the uses of the other scales. Pointers in improving accuracy and minimizing motions were also offered, the emphasis being on the most efficient and effective use of the engineer's tool. These classes represent the first service project of the engineering honorary this term.

Annual Meeting of ASME

During the week of November 27, the American Society of Mechanical Engineers held its seventy-first annual meeting at the Hotel Statler in New York City. Three Cornell professors presented papers at the meeting, and five others attended various sessions and committee meetings.

"Predetermined Elemental Motion Times—a Step Forward in Work Standardization" was the paper given by Professor K. C. White of the Administrative Engineering Department. During the past year Professor White has been working with Methods Time Measurement, a new procedure for estimating elemental motion times.

Professor D. G. Shepherd of the Heat Power Department presented "A Review of the Combustion Phenomena for the Gas Turbine" on November 29.

Professor H. D. Conway of the Engineering Mechanics Department presented two papers—one on "Axially Symmetrical Plates with Linearly Varying Thickness," and the other on an "Analysis of Deep Beams."

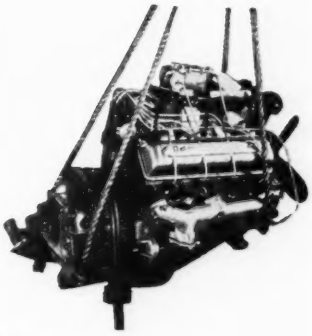
ASCE News

Among the outstanding programs presented by ASCE this term was a three-dimensional color film entitled "Highway, USA" shown by a representative of the Barber Greene Co. At another meeting, Frederick G. Switzer, Division Engineer, New York City Board of Water Supply, spoke on "New York's Water Supply—Past Problems and Future Plans." With military service for engineering students an imminent possibility, another meeting featured advice on how to get into an engineering unit with the armed forces.

The student ASCE officers for

(*Concluded on page* 30)

THE DU PONT DIGEST



On the road and in the laboratory, Du Pont scientists are writing

The Inside Story of Engine Deposits

Engineers have long known that deposits which accumulate in gasoline engines have a direct bearing on engine performance. Even now, however, no way has been found to eliminate these deposits or their effects.

As a manufacturer of chemicals used by the petroleum industry, the Du Pont Company has a particular interest in this problem. It is currently the subject of a comprehensive research project, conducted both on the road and in the laboratory.

When Du Pont engineers began their studies, some aspects of the relationships between engine, fuel, lubricant, operating conditions and deposits were known. But to understand how and why deposits form and to develop corrective measures, they needed additional information.

Engineers take to the road

To get these facts, Du Pont engineers are supervising tests in a fleet of passenger cars and trucks that travel hundreds of thousands of miles yearly under carefully controlled conditions. The effects of deposits on octane number requirement, valve performance, spark plug condition and other performance characteristics are measured. After each test, the deposits are weighed and examined physically and chemically.

In the laboratory, other engineers study the effects of the same variables on multicylinder engines. Here, where closer control of the engines is possible, greater attention can be paid to specific fuel or engine operating effects. Performance factors, such as power output, can be more conveniently measured.

A third group of Du Pont engineers uses single cylinder engines in laboratory studies of deposit formation, adhesion, removal and harm. Exploring new fields, these men had to design complex instrumentation for measuring factors such as surface condition and deposit thickness.

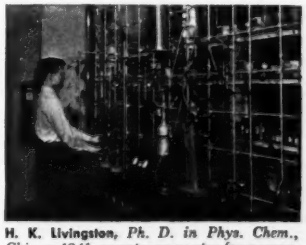
Chemists synthesize deposits

Chemists, too, have an important place in this research. They study the chemical and physical characteristics of engine deposits. Among other things, they devise ways of synthesizing, in fired engines, deposits consisting almost entirely of a single chemical compound in order to study its effect on engine performance.

The results of this comprehensive research program are not yet conclusive, although the relationships between engine, fuel, lubricant, operating condition and deposit formation and harm are much better understood. In the past Du Pont scientists have licked even more difficult problems. Working as a team, they will persist in their effort to provide the motorist with improved engine performance through better fuels.

Douglas L. Schultz *(center), B.S. in M.E., M.I.T. 1947, supervises installation of engine for study of deposit formation in truck operating under heavy-duty conditions.*

W. E. Bettoney *(left), B.S. in M.E., Maine 1939, tests installation of single-cylinder gasoline engine used in study of factors influencing deposit formation in the combustion chamber.*



H. K. Livingston, *Ph. D. in Phys. Chem., Chicago 1941, operates apparatus for measuring porosity and absorptivity of combustion chamber deposits taken from test engines of the Du Pont automobile test fleet.*

DID YOU KNOW . . .

. . . about 60% of Du Pont's sales today consist of products that didn't exist or weren't commercially available 20 years ago.

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This is the pump with the deep stuffing box under suction pressure only. Entrance of grit into stuffing box is minimized —slurry dilution from stuffing box leakage negligible. The pump requires only nominal sealing water pressure, yet can operate under high vacuum as well as high suction heads. Because of this design, stuffing box troubles are practically eliminated.

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Branch Offices in Principal Cities
John C. Meyers, Jr., E.E., '44, Executive Vice-Pres.

College News

(*Continued from page* 28)

this term are: Ed Watson, President; Ed Bergun, Vice-president; Bob Freer, Secretary; and Monte Morgan, Treasurer.

Pi Tau Sigma Elections

At the conclusion of a smoker held on November 30 at Sigma Nu fraternity, eleven men in the Sibley School of Mechanical Engineering were elected to membership in Pi Tau Sigma, national honorary mechanical engineering fraternity.

Eligibility for membership in the organization is determined by the class standing of a candidate. But the group that may be admitted is smaller than the number who qualify scholastically, according to the constitution of the national organization. For this reason, students are selected on the basis of extra-curricular activities and character as well as scholarship.

The following students were elected to membership:

Lawrence L. Browning, Jr.
David L. Cohoe, Jr.
John K. Howell
Oliver D. JoJhnson
John E. Nickles
John Phifer
Bernard N. Roth
Elliott J. Siff
Robert S. Stahr
Ramon L. Street
George W. Sutton

Kappa Tau Chi Elections

At an informal smoker held on December 6, Kappa Tau Chi, local honorary group for men in the Administrative option of Mechanical Engineering, elected ten new members. They were selected on the basis of scholarship, extracurricular activities, and interest in the work of Kappa Tau Chi.

Those recently elected to membership were:

James R. Baum
Robert D. Jensen
A. Donald Klingenberg
George R. Kreisel, Jr.
Roy R. Payne, Jr.
Charles Pfretzschner
John C. Phifer
John T. Rogers
Ramon L. Street
George W. Sutton

Techi-Briefs

(*Continued from page 15*)

camera to record the projectile's speed are mounted in a camera car which travels on a standard gauge railway close to the water's edge, so that cameras may be readily placed in correct position for photographing a launching.

Three 70-mm motion picture cameras protected by concrete sheds photograph side views, while other cameras record the torpedo course from behind the launching platform and from an aerial cable suspended above the range.

New Generator Brushes

Dr. Howard M. Elsey, consulting chemist at the Westinghouse Research Laboratories, Pittsburgh, Pa. has revealed that specially treated carbon brushes—which pick up and relay power to the plane's electrical system — have increased the high-altitude life of jet engines by many times. Development of the new brush was a key factor in the U. S. Air Force's program to extend the range and flying hours of jet planes without frequent brush replacement.

Carbon brushes are small, porous blocks of carbon that convey electricity from the rotating commutator of the generator to the plane's radio, gun turrets, and other vital auxiliaries. In the extremely dry air of 40,000- or 50,000-foot altitude, these brushes must create their own lubrication; otherwise they will grind themselves to powder against the copper commutator and the flow of electricity will stop.

Dr. Elsey solved the problem by impregnating the brushes with a special chemical compound belonging to the same family as table salt. As the brushes are pressed against the revolving commutator, the new ingredient promotes the formation of a lubricating film that prevents harmful friction at the highest altitudes attainable.

Dr. Elsey, who won acclaim during the last war for his development of carbon brushes for propeller-driven airplanes, said that the problem is many times tougher for jet engines. The temperatures created on the face of the brushes during the starting phase of jet engines using starter-generators may run as high as 1,000 degrees Fahrenheit, he explained. This may evaporate the chemical treatment in the carbon brush, so that when the plane reaches an altitude of forty or fifty thousand feet, the brush cannot produce the necessary lubricating film.

Prominent Engineers

(*Continued from page 13*)

Bob, and a supporter of another social group from Buffalo, Scalp and Blade.

Norm makes friends easily and soon wins their respect. He has entered wholeheartedly into most of his school's activities, played on its intramural teams, been active in its societies; yet with these activities he has remained near the top of his class. Despite all this, though, he is in the same position with the rest of us—he too expects to be drafted in June.

Turn your second hand Books into hard cash—

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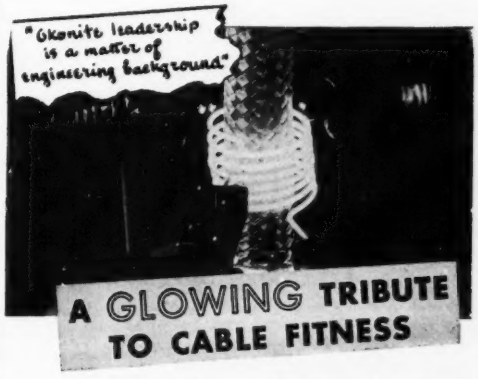


A GLOWING TRIBUTE TO CABLE FITNESS

Is a cable covering flameproof? Will it resist high temperatures when it comes to actual service?

Long before a cable is manufactured, questions like these are answered in the Okonite laboratories, proving ground and in various testing departments of the Okonite plants. The picture above shows a flame test. The measured current that makes the coils glow makes it possible to reproduce test after test without variation. The Okonite Company, Passaic, New Jersey.

OKONITE 5238

insulated wires and cables

STRESS and STRAIN...

An Engineer, inviting a friend to his wedding anniversary, explained how to find him in the apartment where he lived. "Come to the seventh floor," he said, "and where you see the letter 'D' on the door, push the button with your elbow, and when the door opens put your foot in it."

"Why do I have to use my elbow and my foot?" asked his friend.

"Well, for heaven's sake!" exclaimed the Engineer. "You're not coming empty-handed, are you?"

* * *

Suitor: "Sir, may I have your daughter for my wife?"

Father: "Trot your wife around and I'll see."

* * *

Professor: "Didn't you have a brother in this course last year?"

Student: "No, sir; it was I. I'm taking it over again."

Professor: "Extraordinary resemblance, though—extraordinary."

* * *

Manager to applicant for bookkeeping job: "Of course you understand double entry?"

Applicant: "Nothing to it. Once I kept books triple entry. One set for the boss, showing the profits, a second for stockholders, showing no profits, and a third for the income tax people, showing a loss."

* * *

An EE says:

If your sweetheart is a blond and you love a brunette, transformer.
If she gets grouchy, tickler.
If she wants to meet you for lunch, meter.
If she wants a fur coat, resistor.
If she continues to insist, eliminator.

And when you get through with that cigarette wipe the ashes off your teeth.

* * *

A group of engineers were coming home from a party one night. They stood in front of the house of one of their number and called for the father.

"Will you please do ush a favor?" asked one.

"What do you want?" replied the father.

"Will you please come out here and pick out Johnnie so the rest of ush can go home?"

* * *

Drugstore clerk: "Did you kill any moths with those moth balls I sold you the other day?"

Customer: "No, I tried for five hours, but I couldn't hit one."

* * *

Prof: "Mr. Jones, I hate to tell you, but your son is a moron."

Jones: "Where is he, I'll teach that young pup to join a fraternity without consulting me."

* * *

Three gentlemen appeared at the railroad station, alcoholically propelled. As they reached the platform, the train began to move, and all three staggered for it. The station cop and a porter managed to bundle two of them aboard—one on the last car—but by this time it was going too fast for the third gent. He stood sadly on the platform watching it disappear.

"Too bad, mister," the cop said. "Wish you could have gone aboard."

....."Yes," replied the man, "and my frens'll be sorry too. They were seeing me off!"

The gas company in a small college town town inserted the following advertisement in the local newspaper:

Wanted: Hard boiled, beauty-proof man to read meters in sorority houses. We haven't made a dollar in two years.

* * *

"Is this a picture of your fiancee?"

"Yes."

"She must be wealthy."

* * *

"My wife says that if I don't quit golf, she'll leave me."

"I say—hard luck!"

"Yes, I'll miss her."

* * *

"Hello, is this the Home Economics School?" asked Mrs. Swift, a Christmas bride.

"Yes, it is," came the reply.

"Well, those biscuits you taught me how to make, I don't think they are very good."

"Why not?"

"Keith sat down at the table five days ago, and ate six of them. Then he just sat back and smiled."

"Smiled, eh?"

"Yes, and he's still sitting there smiling."

* * *

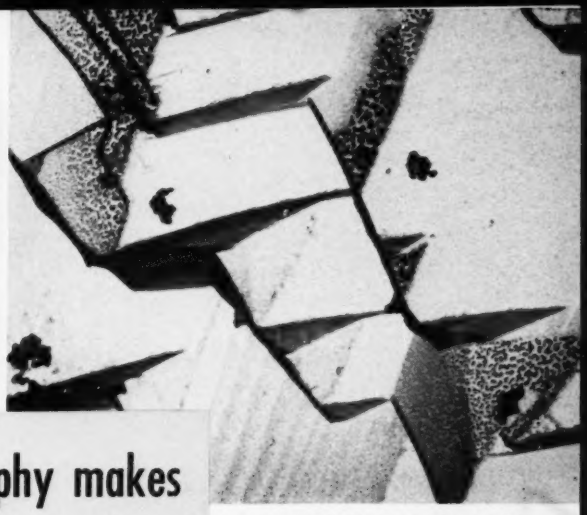
Chemical Engineer: "They laughed when I started to make a new kind of dynamite, but when I dropped it, they exploded."

* * *

Salesman: "Is your mother engaged?"

Little boy: "I think she's married."

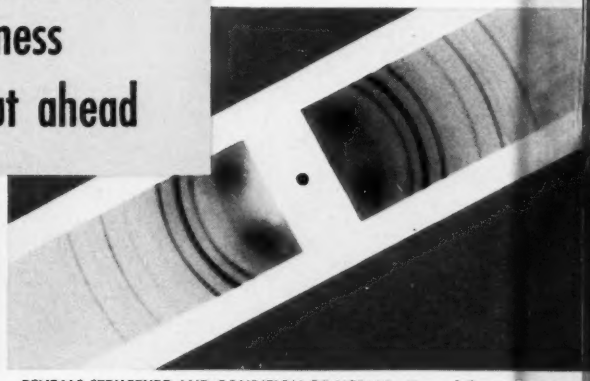
DISPLAYS MASSIVE PRODUCTS—A Diesel locomotive can roar across the Rockies—all on a movie screen in a prospect's office. All because photography can take huge things or small, and make them of a size for a salesman, teacher, or demonstrator to show.



Photography makes big things small—small things big—and business comes out ahead

MAKES MICROSCOPIC DETAILS CLEAR—Photography takes great magnifications produced by the electron microscope (20,000X) on fine-grain Kodak plates, enlarges and records them up to 100,000X on Kodak projection papers. Previously undetectable details and new facts are revealed.

REDUCES FILING SPACE BY 98%—With microfilming, bulky records can be reduced and stored on a few rolls of film. 675 drawings, 24" x 36", can be recorded on a 100' roll of 35mm. Recordak or Kodagraph Micro-File Film. And everything is quickly ready for reference in the Recordak or Kodagraph Film Reader.



REVEALS STRUCTURE AND CONDITION OF METALS—X-ray diffraction patterns on Kodak films or plates provide important information concerning the crystal structure of metals. These patterns help show how alloys can be improved or new alloys made—give data on the effect of machining, drilling, and punching upon the structure of the material.

WITH THE SPEED of a flick of light, photography can reduce or enlarge accurately to scale, and without missing the tiniest detail. And that's not all.

It can magnify time with the high speed motion-picture camera so that the fastest motion can be slowed down for study. It can record the penetrating x-ray and reveal internal conditions of materials and products. With movies and stills, it can repeat a story, time and again, without the loss of a single detail.

Yes, photography serves business and industry in many important and valuable ways. It can work for you, too. If you would like to know how, please feel free to write for literature, or for specific information which could be helpful to you. Eastman Kodak Company, Rochester 4, New York.

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SILICONES, compounds with unusual resistance to high and low temperatures, now being manufactured by G.E.

REMOTE-CONTROL WIRING—new low-cost, low-voltage control system lets you turn on lights from many points, or from master switch.

GAS TURBINE locomotive, first in U. S., is now on test with American railroads. It's propelled by power unit similar to that used in aircraft jet engines.

These new G-E developments are creating exciting new opportunities for G-E men

The gas turbine, drawing power from red-hot gases, is being applied by General Electric to the propulsion of locomotives, ships, and planes, and to the generation of electricity. More than 350 G-E engineers, physicists, and other specialists, assigned to this work, are in on the ground floor of a development that promises to revolutionize the production of power.

It's a similar story for the chemists, chemical engineers, and other specialists working today in the development of G-E silicones, and for those who are helping to win a place in the construction industry for General Electric remote-control wiring.

New developments like these, springing from G-E research, are opening up new opportunities at General Electric, and are giving more college graduates the chance of finding exciting, satisfying work.

By placing prime importance on the development of talent and skill, by providing opportunities and incentives for creative minds, General Electric keeps ahead in electrical research, engineering, and manufacturing.

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